



General

Guideline Title

ACR Appropriateness Criteria® radiologic management of uterine leiomyomas.

Bibliographic Source(s)

Knuttinen MG, Stark G, Hohenwarter EJ, Bradley LD, Braun AR, Gipson MG, Kim CY, Pinchot JW, Scheidt MJ, Sella DM, Weiss CR, Lorenz JM, Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® radiologic management of uterine leiomyomas. Reston (VA): American College of Radiology (ACR); 2017. 13 p. [87 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Burke CT, Ray CE Jr, Lorenz JM, Darcy MD, Fidelman N, Hohenwarter EJ, Kinney TB, Kolbeck KJ, Kouri BE, Nair AV, Rochon PJ, Shaw H, Vatakencherry G, Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® radiologic management of uterine leiomyomas. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 8 p. [62 references].

This guideline meets NGC's 2013 (revised) inclusion criteria.

NEATS Assessment

National Guideline Clearinghouse (NGC) has assessed this guideline's adherence to standards of trustworthiness, derived from the Institute of Medicine's report [Clinical Practice Guidelines We Can Trust](#).

■■■■= Poor ■■■= Fair ■■■= Good ■■■= Very Good ■■■= Excellent

Assessment	Standard of Trustworthiness
YES	Disclosure of Guideline Funding Source
■■■■	Disclosure and Management of Financial Conflict of Interests

	Guideline Development Group Composition
YES	Multidisciplinary Group
YES	Methodologist Involvement
■□□□□	Patient and Public Perspectives
	Use of a Systematic Review of Evidence
■■■■■	Search Strategy
■■■□□	Study Selection
■■■■■	Synthesis of Evidence
	Evidence Foundations for and Rating Strength of Recommendations
■■□□□	Grading the Quality or Strength of Evidence
■■■■■	Benefits and Harms of Recommendations
■■■■■	Evidence Summary Supporting Recommendations
■■■■■	Rating the Strength of Recommendations
■■■■■	Specific and Unambiguous Articulation of Recommendations
■□□□□	External Review
■■■□□	Updating

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Radiologic Management of Uterine Leiomyomas

Variant 1: Middle-aged woman with multiple uterine fibroids resulting in a 20-week-sized uterus on physical examination and menorrhagia. Bulk symptoms of urinary frequency and bloating are present. The patient has a recent negative serum pregnancy test and has no desire for future fertility.

Procedure	Appropriateness Category
Medical management	Usually Not Appropriate
MR-guided high-frequency focused ultrasound ablation	Usually Not Appropriate
Endometrial ablation	Usually Not Appropriate
Uterine artery embolization	Usually Appropriate
Laparoscopic uterine artery occlusion	Usually Not Appropriate

Myomectomy	Procedure	Usually Not Appropriate
Hysterectomy		Usually Appropriate

Variant 2: Childbearing-age woman with multiple submucosal and intramural fibroids presents with menorrhagia and pelvic pain. Most of the fibroids measure <4 cm, with two dominant fibroids measuring >6 cm. Uterus is 12 cm on MRI. The patient states that she does not desire future pregnancies and is concerned about the loss of femininity with hysterectomy.

Procedure	Appropriateness Category
Medical management	Usually Not Appropriate
MR-guided high-frequency focused ultrasound ablation	Usually Not Appropriate
Endometrial ablation	Usually Not Appropriate
Uterine artery embolization	Usually Appropriate
Laparoscopic uterine artery occlusion	Usually Not Appropriate
Myomectomy	Usually Not Appropriate
Hysterectomy	May Be Appropriate

Variant 3: Childbearing age woman with menometrorrhagia. On MRI she has three dominant leiomyomas, ranging in size from 6 to 8 cm and intramural in location. She states that she does not have plans for future pregnancy but would like to have the option in the future.

Treatment/Procedure	Appropriateness Category
Medical Management	Usually Not Appropriate
MR-guided high-frequency focused ultrasound ablation	May Be Appropriate
Endometrial ablation	Usually Not Appropriate
Uterine artery embolization	Usually Appropriate
Laparoscopic uterine artery occlusion	Usually Not Appropriate
Myomectomy	Usually Appropriate
Hysterectomy	Usually Not Appropriate

Variant 4: Middle-aged woman with menorrhagia. MRI reveals a single 3 cm intramural fibroid and diffuse adenomyosis.

Procedure	Appropriateness Category
Medical management	Usually Not Appropriate
MR-guided high-frequency focused ultrasound ablation	Usually Not Appropriate
Endometrial ablation	May Be Appropriate
Uterine artery embolization	Usually Appropriate
Laparoscopic uterine artery occlusion	Usually Not Appropriate
Myomectomy	Usually Not Appropriate
Hysterectomy	Usually Appropriate

Variant 5: Middle-aged woman with pelvic discomfort and 8 cm pedunculated subserosal fibroid on MRI.

Treatment/Procedure	Appropriateness Category
Medical management	May Be Appropriate
MR-guided high-frequency focused ultrasound ablation	Usually Not Appropriate
Endometrial ablation	Usually Not Appropriate
Uterine artery embolization	Usually Appropriate
Laparoscopic uterine artery occlusion	Usually Not Appropriate
Myomectomy	Usually Appropriate
Hysterectomy	Usually Appropriate

Variant 6: Middle-aged woman with constipation. MRI reveals a 12 cm subserosal leiomyoma compressing the rectum.

Procedure	Appropriateness Category
Medical management	Usually Not Appropriate
MR-guided high-frequency focused ultrasound ablation	Usually Not Appropriate
Endometrial ablation	Usually Not Appropriate
Uterine artery embolization	Usually Appropriate
Laparoscopic uterine artery occlusion	Usually Not Appropriate
Myomectomy	Usually Appropriate
Hysterectomy	Usually Appropriate

Summary of Literature Review

Introduction/Background

Uterine leiomyomas (also known as fibroids or myomas) are the most common tumor in women of reproductive age, affecting more than 66% of women by 50 years of age. They are the leading cause for hysterectomy in the United States. Leiomyoma treatment is typically indicated to treat the symptoms of the fibroids, such as abnormal uterine bleeding, bulk-related symptoms, and/or pain. Approximately 1 in 350 women undergoing hysterectomy or myomectomy for the treatment of fibroids is found to have an unsuspected uterine sarcoma.

Discussion by Variant

Variant 1: Middle-aged Woman with Multiple Uterine Fibroids Resulting in a 20-week-sized Uterus on Physical Examination and Menorrhagia. Bulk Symptoms of Urinary Frequency and Bloating are Present. The Patient Has a Recent Negative Serum Pregnancy Test and Has No Desire for Future Fertility

Variant 2: Childbearing-Age Woman with Multiple Submucosal and Intermural Fibroids Presents with Menorrhagia and Pelvic Pain. Most of the Fibroids Measure <4 cm, with Two Dominant Fibroids Measuring >6 cm. Uterus Is 12 cm on MRI. The Patient States That She Does Not Desire Future Pregnancies and Is Concerned About the Loss of Femininity with Hysterectomy

Uterine Artery Embolization

Appropriate patient selection and management are integral to successful outcomes with uterine artery embolization (UAE). The following is a brief description of the procedure and patient management as detailed by the Society of Interventional Radiology Task Force on Uterine Artery Embolization.

Prior to UAE, all prospective patients should undergo a full gynecologic workup including a Pap smear every 3 years and/or an endometrial biopsy if a patient has menometrorrhagia. Cross-sectional imaging,

preferably magnetic resonance imaging (MRI), or ultrasound (US) is done to confirm the diagnosis of uterine leiomyomas and exclude other pelvic pathology. Viable pregnancy and active pelvic inflammatory disease are two absolute contraindications for the procedure and must be excluded. The procedure is typically performed under conscious sedation using either a unilateral or bilateral common femoral artery approach, depending on operator preference. Both uterine arteries are selectively catheterized, when possible, with the catheter advanced distal to nontarget branches. Both uterine arteries are then embolized. The goal is the occlusion of all distal uterine artery branches feeding the leiomyomas(s). Particulate embolic agents are typically used to achieve a distal embolization. Afterward, the patient is observed and treated for postprocedure pain and/or nausea. The patient is followed closely for the first 24 to 48 hours after discharge for adequacy of pain and nausea control and to assess for potential complications. At 3 to 6 months following the procedure, the patient is re-evaluated for treatment efficacy. Follow-up imaging may also be performed to determine fibroid volume reduction and to assess for incomplete fibroid infarction. Additionally, MRI after UAE is recommended to not only ensure adequate fibroid infarction but to exclude underlying leiomyosarcoma.

Outcomes

UAE for the treatment of uterine leiomyomas was first reported in 1995, and since that time numerous reports have been published documenting clinical success rates of 81% to 100%. Currently, registries remain the largest source of data for evaluating the efficacy of UAE. Results from the Ontario Uterine Fibroid Embolization Trial, a multicenter, prospective registry, showed median uterine and dominant fibroid volume reductions of 35% and 42%, respectively. In addition, there was significant improvement for patients with menorrhagia (83%), dysmenorrhea (77%), and urinary frequency (86%) at 3 months after the procedure. One of the largest registries to date, the Fibroid Registry for Outcomes Data (FIBROID), comprised more than 3,000 women who underwent UAE at 72 sites. At 12 months, 95% of patients who were followed up reported symptomatic improvement and improved quality of life scores. For the more than 1,200 patients enrolled in this registry, data showed continued statistically significant improvement in symptoms and quality of life based on questionnaires. During the 3-year period, 14.4% of the patients underwent additional procedures (9.8% repeat UAE, 2.8% myomectomy, and 1.8% hysterectomy).

Complications

Overall, the reported complication rates for UAE remain low, with major complications occurring in <3% of patients. More commonly, up to 10% of patients may need to be readmitted for pain control. Amenorrhea can occur in up to 10% of patients following UAE. The risk of permanent amenorrhea appears to be age-dependent. For women younger than age 45 the risk is <2% to 3%, whereas for women >45 years of age it is up to 20%.

Durability

As with other uterine-sparing procedures, there is uncertainty about the durability of symptom relief with UAE. Trying to identify prospectively which patients will have better clinical results is difficult. Within the registry data, the two groups that showed better long-term outcomes were women presenting with abnormal uterine bleeding and women with smaller leiomyomas. Nevertheless, in a small retrospective analysis one study reported symptomatic improvement at 16 months in 5 of 6 patients with diffuse leiomyomatosis. In addition, a retrospective study showed no difference in outcomes or complications in patients with large fibroid volumes when compared with published outcomes for other patients treated with UAE. In a retrospective analysis, researchers found two preoperative factors to be predictive of success: hypervascularity of the nodules and multiplicity of nodules. Conversely, a different study found no correlation between fibroid characteristics and outcome.

Overall, there is 20% to 25% incidence of symptom recurrence at 5 to 7 years after UAE, though most women report continued high quality of life scores. One study reported continued symptom relief in 67 of 93 women (72%) at a median follow-up of 54 months. Of those patients with treatment failure, 11 (42%) underwent a hysterectomy. In a separate study, 73% of patients maintained symptom control 5 years after the procedure. Location of fibroids is of importance in adequately assessing appropriate patient

selection. A retrospective study looked at women with cervical fibroids and found a high treatment failure and reintervention rate in this particular group. Similarly, greater than one submucosal fibroid has been associated with incomplete infarction, requiring repeat reintervention. Another study also highlighted the impact of age on higher rates of treatment failure post-UAE. In a study of 380 patients, a 23% treatment failure rate occurred at 10 years for UAE, which was significantly worse for patients <40 years of age. This age difference is likely due to the increased time available for recruitment of other collateral vessels (i.e., the ovarian arteries) in these women. Despite the relatively high recurrence rate in long-term follow-up, repeat embolization has been shown to be effective for most of these patients, and UAE does not preclude other therapies when unsuccessful.

Endometrial Ablation

Endometrial ablation (EA) is used for treating abnormal uterine bleeding from a variety of causes, including symptomatic submucosal myomas. Because it ablates the uterine cavity, it should not be used in women desiring future pregnancy. There are also uterine cavity size limitations for most currently available devices, with most devices able to treat uterine cavities up to 10 cm in size. In a study of 438 women treated with EA for menorrhagia, there was >95% overall patient satisfaction. Within this cohort, 143 patients were diagnosed preoperatively with uterine fibroids, 2 of whom went on to hysterectomy due to persistent symptoms associated with the uterine fibroids. In a separate study, investigators found a 23% failure rate in treating patients with submucosal fibroids compared with a failure rate of 4% in patients with normal uterine cavities.

Hysterectomy

Hysterectomy (total abdominal hysterectomy or laparoscopic) is the most common treatment for symptomatic fibroids; approximately 150,000 to 200,000 hysterectomies are performed each year in the United States for fibroids, and it is considered the definitive therapy. The primary advantage is that by completely removing the uterus, there is little potential for fibroid recurrence. In addition, alternative causes of symptoms, such as adenomyosis, will also be effectively treated. Overall, this therapy is met with very high patient satisfaction scores, with up to 90% of patients reporting at least moderate satisfaction 2 years after hysterectomy for symptomatic fibroids. However, many women who undergo hysterectomy later regret the loss of fertility or have concerns regarding their femininity and may undergo earlier onset of menopause. Increased risk of ovarian failure is a possible consequence of premenopausal hysterectomy, even with ovarian preservation. In a prospective cohort study, women who underwent hysterectomy with ovarian preservation still had a nearly two-fold increased risk for ovarian failure.

To date, there have been multiple prospective, randomized trials comparing UAE to hysterectomy. These studies have shown both treatments to have very high clinical success rates and very high rates of patient satisfaction. Within the study performed by the Randomized Trial of Embolization versus Surgical Treatment for Fibroids (REST) investigators, women with symptomatic fibroids were randomly assigned to undergo either UAE or surgery in a ratio of 2:1 and followed for 1 year. There were 95 women in the UAE group and 45 women in the surgical group, with most women in the surgical group undergoing hysterectomy. The UAE group had significantly shorter hospitalization stays and shorter recovery times before returning to work. At 12 months, the patients who underwent surgery had significantly better symptom scores, though there was no significant difference in quality of life scores.

The EMMY (EMbolization versus hysterectoMY) trial randomized 177 patients to undergo either UAE or hysterectomy. There was no significant difference in physical component summary scores beyond 6 weeks, and >90% of patients in each group were at least moderately satisfied with their procedure at the 2-year follow-up. These improvements remained stable, with no significant difference between the two groups at 5-year follow-up.

As part of the EMMY trial, concerns over body image and sexuality were also evaluated between patients receiving hysterectomies and those receiving UAEs. At 2 years, there was no statistical difference in the sexuality or body image scores of the 2 groups.

In a multicenter, nonrandomized prospective study, hysterectomy was compared to myomectomy and

embolization for improving uterine fibroid-related symptoms and the effect on health-related quality of life. This study, despite showing all three therapies as extremely effective in reducing fibroid-related symptoms, did demonstrate a significantly better health-related quality of life advantage for patients treated with hysterectomy.

Furthermore, a meta-analysis of the four randomized clinical trials including 515 patients comparing UAE versus hysterectomy demonstrated significantly greater short-term benefits of UAE (shorter hospital stay, decreased blood loss) with similar long-term quality-of-life measurement but increased percentage of long-term reintervention.

Morcellation in minimally invasive hysterectomy can increase the risk of abdominopelvic recurrence and lower disease-free survival in women who have underlying occult malignancy. Morcellation is not recommended because of risk of increasing stage of possible sarcoma.

Variant 3: Childbearing Age Woman with Menometrorrhagia. On MRI, She Has Three Dominant Leiomyomas, Ranging in Size from 6 to 8 cm and Intramural in Location. She States That She Does Not Have Plans for Future Pregnancy but Would Like to Have the Option in the Future

Pharmaceutical Treatment

The least invasive treatment option remains medical therapy with either oral contraceptive medication or gonadotropin-releasing hormone (GnRH) agonists/antagonists. Oral contraceptives may manage bleeding symptoms effectively, especially in women with small fibroids. GnRH agonists have been shown in several studies not only to be effective against symptoms of bleeding but also to result in reduction in uterine volume and myoma volume, making them effective against bulk-related symptoms. However, these agents have several drawbacks. First, once the agent is discontinued, the fibroids quickly return to their previous volume and the fibroid-related symptoms typically recur. In addition, chronic use of GnRH agonists results in trabecular bone loss. Therefore, these agents are typically used for temporary situations, such as to reduce uterine and myoma size prior to surgical therapy. Mifepristone, a partial progesterone agonist, has shown promising initial results; however, more long-term studies are needed.

Tranexamic acid is a nonhormonal agent that has been used previously for the treatment of dysfunctional uterine bleeding. Its role in abnormal menstrual bleeding attributed to uterine fibroids remains unclear. Its use may cause necrosis in fibroids and help reduce the menorrhagia associated with fibroids; however, adverse effects such as pelvic pain and fever may result.

Myomectomy

Myomectomy is a surgical alternative that may be performed when uterine conservation is desired. As with other uterine-sparing procedures, there is a risk for myoma recurrence. Using either an abdominal or laparoscopic approach, the recurrence rate ranges from 23% to 33%. In a large, multicenter study, laparoscopic myomectomy was associated with 2% major complication and 9% minor complication rates.

At least three studies have been performed directly comparing myomectomy to UAE. In one study, there was a reduction in the procedural and recovery times, as well as fewer adverse events, with UAE; however, similar rates of clinical success were reported. One study reported significantly higher symptomatic improvement scores for patients undergoing UAE compared with myomectomy, but there was no significant difference in patient satisfaction scores. The Prague Trial followed patients in both groups for a minimum of 12 months and found no difference in clinical outcomes. However, the UAE group had higher reintervention rates; 36% in the UAE group compared to 5% in the myomectomy group. Reintervention rates were higher in those patients who had fibroids >5 cm. In a prospective, nonrandomized comparison, investigators demonstrated that UAE performed with spherical polyvinyl alcohol had a significantly greater sustained reduction in tumor-related symptoms up to 24 months after intervention, with fewer complications, compared to myomectomy.

Laparoscopic Uterine Artery Occlusion

There are limited published data about laparoscopic uterine artery occlusion (LUAO) as a stand-alone

treatment for uterine leiomyomas. In a small retrospective study, 9% of women treated with LUAO developed myoma recurrence at a median follow-up of 23.6 months. There are several studies comparing LUAO to UAE. A randomized evaluation of 20 patients found similar outcomes between the 2 procedures for menstrual blood loss, uterine volume, and volume of the dominant fibroid at 6 months, though menorrhagia symptoms did recur in 4 out of 10 patients in the LUAO group. In another small randomized controlled trial, LUAO achieved shorter hospital stays and reduced procedural pain compared to UAE, while achieving similar 3-month clinical success rates. In a separate study, the degree of bleeding reduction was similar between the two procedures. In this study, only 4% of patients treated with UAE continued to complain of symptoms, compared with 21% in the LUAO group (though this finding did not reach statistical significance). At a median follow-up of 48 months, there was clinical failure and symptom recurrence in 48% of patients treated with LUAO compared with 17% of patients treated with UAE. In a prospective randomized study that included 96 patients, there was no significant difference in outcomes between the two treatment groups at 12 months.

In a meta-analysis of five trials involving 436 patients, LUAO was compared with UAE and myomectomy and found to be less effective in both clinical measures and patient satisfaction. In a prospective trial, UAE was more effective at causing complete ischemia of fibroids but was associated with greater risk of intrauterine necrosis (31% versus 3%).

High-Intensity Focused Ultrasound

MR-guided high-intensity focused ultrasound (HIFU or MRgFUS) is another uterine-sparing option to treat focal leiomyomas. It is noninvasive, though each treatment may take several hours to complete. Its use currently is restricted to patients with fewer than six leiomyomas or leiomyoma volume $<900\text{ cm}^3$.

To date, there is little long-term information on the efficacy of this technology. It has been reported that myomas treated with HIFU have nearly 50% volume reduction at 1 year, but viable cells are present at biopsy in nearly 26% of specimens. One set of investigators report a 24-month volume reduction of 40% with significant symptomatic improvement at 6 months that remained stable at 24-month follow-up. In a multicenter trial, researchers demonstrated significant reduction in fibroid-related symptoms in 70% of patients at 6 months and 51% of patients at 12 months.

Although a reasonable alternative for patients unable/unwilling to tolerate sedation/anesthesia, long-term data and viability results are still lacking. One study compared MRgFUS to UAE and found significantly higher reintervention rates (67% versus 12%) and lower quality of life.

Fertility

The issue of fertility following UAE remains an area of great controversy. The impact on future fertility and subsequent delivery remains uncertain. It has been shown that over 60% of women who attempted to become pregnant after UAE had abnormal hysteroscopies, particularly with higher incidence of intrauterine necrosis (43%). However, the significance of these findings remains unknown. There are reports of uncomplicated pregnancies following UAE, but because of small sample sizes, the overall risk remains unclear. In one study, 33 out of 56 women who went on to get pregnant following UAE had successful outcomes. Another study demonstrated a 50% success rate (22 out of 44) for patients desiring pregnancy, without any significant increase in complication rate during their pregnancies.

There have been several reports comparing the impact of UAE and myomectomy on fertility. In a multicenter retrospective trial, investigators found that women treated with fibroid embolization were at an increased risk for preterm delivery and breech presentation when compared with women treated with myomectomy. In this same study, there was also an increased risk of postpartum hemorrhage and spontaneous abortion in the UAE group, but this difference did not reach statistical significance. Furthermore, in the only prospective, randomized comparison, there was a statistically significant advantage for myomectomy in both the number of successful pregnancies and the number of early pregnancy losses. However, it should be noted that in this study, myomectomy was allowed in 26% of patients who underwent UAE with fibroids $>5\text{ cm}$ persisting at 6 months. Therefore, one-fourth of the UAE cohort underwent both UAE and myomectomy procedures. The UAE group also had a higher failure rate

(11%) than in most studies. Additionally, the myomectomy group underwent either laparoscopic or open procedure, which calls into question the generalizability of results. When the risk of future pregnancy complications was studied in patients undergoing either UAE or LUAO, there was also an increased risk of spontaneous abortion following UAE compared with LUAO.

A meta-analysis looked at the outcomes of all reported pregnancies in women (n = 227) who had undergone UAE compared to controls from a variety of studies that looked at reproductive outcomes. The significant complications from UAE in these women included an increase in miscarriage (35%), increase in Cesarean sections (66%), and an increase in postpartum hemorrhage (13.9%).

Studies to date demonstrate that UAE should not be considered the first-line choice in women seeking pregnancy, and myomectomy should be offered as the first therapeutic choice. UAE can still be considered in this subgroup of women in certain situations, such as those who are poor surgical candidates, those who have fibroids that are not surgically resectable, and in those who have had repeated myomectomies. Although myomectomy is seen as the standard option, there is no robust evidence, and studies need to be performed to investigate whether UAE is superior, inferior, or equal to myomectomy. There is very limited evidence that myomectomy may be superior to UAE in women planning future pregnancy, and higher-quality research is needed. In younger women who have a reasonable chance of future fertility, myomectomy may be a better option, although patient preference for UAE should be respected, as long as she is well-informed on the current evidence. The ongoing UK FEMME trial is a randomized prospective clinical trial that hopes to answer this question.

Another treatment option for patients who are candidates is MRgFUS. However, to date, there is little information regarding the issue of fertility following MRgFUS. In a review of registry data, 54 pregnancies were reported in 51 women. Of these, 41% resulted in live births and 28% in spontaneous abortions. Of those who delivered, there was a 93% term delivery rate with only one preterm birth (36 weeks). Forty-three percent of pregnancies had an associated complication, but no pattern of complications was seen.

Variant 4: Middle-Aged Woman with Menorrhagia. MRI Reveals a Single 3-cm Intramural Fibroid and Diffuse Adenomyosis

Comorbidities

Adenomyosis may be a cause of abnormal uterine bleeding with or without the presence of fibroids. UAE has shown early success in controlling the symptoms of bleeding with adenomyosis. The long-term durability of this success is questionable, with recurrence rates at 2 years of approximately 40% to 50%. In a recent review, long-term symptomatic relief (median follow-up 27.9 months) in patients with pure adenomyosis or adenomyosis with coexistent leiomyomas ranged from 65% to 82%. Additionally, more recent retrospective studies (median follow-up ranged from 24 to 65 months) have reported symptomatic control in 73% to 88%. A prospective study demonstrated significant symptom relief with 83% showing complete adenomyosis necrosis. Therefore, with most recent data showing durability in symptom control and no current therapy demonstrating superiority over the other, UAE for adenomyosis should be considered for patients presenting with symptomatic adenomyosis or concomitant adenomyosis and uterine leiomyomata.

Endometriosis is another cause of abnormal bleeding and can coexist with fibroids. Surgical methods for fibroids and endometriosis can be performed simultaneously, and surgery may be more appropriate in this population.

Variant 5: Middle-Aged Woman with Pelvic Discomfort and 8 cm Pedunculated Subserosal Fibroid on MRI

Variant 6: Middle-Aged Woman with Constipation. MRI Reveals a 12 cm Subserosal Leiomyoma Compressing the Rectum

Both UAE and surgical options (myomectomy and hysterectomy) are viable alternatives in the control of bulk-related symptoms secondary to fibroids. Regarding pedunculated subserosal fibroids, in the past, a case report described post embolization necrosis of the fibroid stalk (defined as a stalk diameter <50% of the greatest diameter of the fibroid) with the fibroid detaching into the pelvis, resulting in hysterectomy.

Based on this report, the presence of pedunculated subserosal fibroids was considered a potential contraindication to UAE. However, more recent studies have addressed these concerns. At least two studies found no instances of fibroid detachment with good clinical outcome and no complications following UAE. Although one study found pedunculated subserosal fibroids to be associated with higher treatment failure rates (which may have been attributable to the small sample size of the failure group and methodology used to determine UAE success), the previous safety concerns have not been validated in larger studies, and symptom improvement is similar among patients without pedunculated leiomyomas.

Summary of Recommendations

Variant 1: Uterine artery embolization or hysterectomy is appropriate.

Variant 2: Uterine artery embolization is appropriate.

Variant 3: Myomectomy or uterine artery embolization is appropriate.

Variant 4: Uterine artery embolization or hysterectomy is appropriate.

Variant 5: Uterine artery embolization, myomectomy, or hysterectomy is appropriate.

Variant 6: Uterine artery embolization, myomectomy, or hysterectomy is appropriate.

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Uterine leiomyomas (also known as fibroids or myomas)

Guideline Category

Evaluation

Management

Treatment

Clinical Specialty

Obstetrics and Gynecology

Radiology

Surgery

Intended Users

Advanced Practice Nurses

Health Care Providers

Hospitals

Managed Care Organizations

Physician Assistants

Physicians

Students

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of treatment procedures for patients with uterine leiomyomas

Target Population

Patients with uterine leiomyomas

Interventions and Practices Considered

1. Medical management
2. Magnetic resonance (MR)-guided high-frequency focused ultrasound ablation
3. Endometrial ablation
4. Uterine artery embolization (UAE)
5. Laparoscopic uterine artery occlusion
6. Myomectomy
7. Hysterectomy

Major Outcomes Considered

- Effectiveness of treatment interventions in the management of uterine leiomyomas in terms of fibroid volume reduction, symptomatic improvement, quality of life, and patient satisfaction
- Success rates and complication rates of procedures

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

Of the 62 citations in the original bibliography, 61 were retained in the final document. Articles were removed from the original bibliography if they were more than 10 years old and did not contribute to the evidence or they were no longer cited in the revised narrative text.

New literature searches were conducted in September 2017 and June 2015 to identify additional evidence published since the *ACR Appropriateness Criteria® Radiologic Management of Uterine Leiomyomas* topic was finalized. Using the search strategies described in the literature search companion (see the "Availability of Companion Documents" field), an additional 1,073 articles were found. Seventeen articles

were added to the bibliography. The remaining articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, the results were unclear, misinterpreted, or biased, or the articles were already cited in the original bibliography.

The author added 8 citations from bibliographies, Web sites, or books that were not found in the new literature searches, including 8 articles outside of the search date ranges.

One citation is a supporting document that was added by staff.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

Number of Source Documents

Of the 62 citations in the original bibliography, 61 were retained in the final document. The literature searches conducted in September 2017 and June 2015 found 17 articles that were added to the bibliography. The author added 8 citations from bibliographies, Web sites, or books that were not found in the literature searches. One citation is a supporting document that was added by staff.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Definitions of Study Quality Categories

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - The study has important study design limitations.

Category 4 - The study or source is not useful as primary evidence. The article may not be a clinical study, the study design is invalid, or conclusions are based on expert consensus.

The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);

Or

The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;

Or

The study is an expert opinion or consensus document.

Category M - Meta-analysis studies are not rated for study quality using the study element method because the method is designed to evaluate individual studies only. An "M" for the study quality will indicate that the study quality has not been evaluated for the meta-analysis study.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Overview

The purpose of the rating rounds is to systematically and transparently determine the panels' recommendations while mitigating any undue influence of one or more panel members on another individual panel member's interpretation of the evidence. The panel member's rating is determined by reviewing the evidence presented in the Summary of Literature Review and assessing the risks or harms of performing the procedure or treatment balanced with the benefits of performing the procedure or treatment. The individual panel member ratings are used to calculate the median rating, which determines the panel's rating. The assessment of the amount of deviation of individual ratings from the panel rating determines whether there is disagreement among the panel about the rating.

The process used in the rating rounds is a modified Delphi method based on the methodology described in the RAND/UCLA Appropriateness Method User Manual.

The appropriateness is rated on an ordinal scale that uses integers from 1 to 9 grouped into three categories (see the "Rating Scheme for the Strength of the Recommendations" field).

Determining the Panel's Recommendation

Ratings represent an individual's assessment of the risks and benefits of performing a specific procedure for a specific clinical scenario on an ordinal scale. The recommendation is the appropriateness category (i.e., "Usually appropriate," "May be appropriate," or "Usually not appropriate").

The appropriateness category for a procedure and clinical scenario is determined by the panel's median rating without disagreement (see below for definition of disagreement). The panel's median rating is calculated after each rating round. If there is disagreement after the second rating round, the rating category is "May be appropriate (Disagreement)" with a rating of "5" so users understand the group disagreed on the final recommendation. The actual panel median rating is documented to provide additional context.

Disagreement is defined as excessive dispersion of the individual ratings from the group (in this case, an Appropriateness Criteria [AC] panel) median as determined by comparison of the interpercentile range (IPR) and the interpercentile range adjusted for symmetry (IPRAS). In those instances when the IPR is greater than the IPRAS, there is disagreement. For a complete discussion, please refer to chapter 8 of the RAND/UCLA Appropriateness Method User Manual.

Once the final recommendations have been determined, the panel reviews the document. If two

thirds of the panel feel a final recommendation is wrong (e.g., does not accurately reflect the evidence, may negatively impact patient health, has unintended consequences that may harm health care, etc.) and the process must be started again from the beginning.

For additional information on the ratings process see the Rating Round Information document (see the "Availability of Companion Documents" field).

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the [ACR Web site](#) (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current medical evidence literature and the application of the RAND/UCLA appropriateness method and expert panel consensus.

[Summary of Evidence](#)

Of the 87 references cited in the *ACR Appropriateness Criteria® Radiologic Management of Uterine Leiomyomas* document, 75 are categorized as therapeutic references including 6 well-designed studies, 38 good-quality studies, and 12 quality studies that may have design limitations. Additionally, 8 references are categorized as diagnostic references. There are 27 references that may not be useful as primary evidence. There are 4 references that are meta-analysis studies.

Although there are references that report on studies with design limitations, 44 well-designed or good-quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Uterine artery embolization (UAE) for the treatment of uterine leiomyomas was first reported in 1995, and since that time numerous reports have been published documenting clinical success rates of 81% to 100%. Results from the Ontario Uterine Fibroid Embolization Trial, a multicenter, prospective registry, showed median uterine and dominant fibroid volume reductions of 35% and 42%, respectively. In addition, there was significant improvement for patients with menorrhagia (83%), dysmenorrhea (77%), and urinary frequency (86%) at 3 months after the procedure. One of the largest registries to date, the Fibroid Registry for Outcomes Data (FIBROID), comprised more than 3,000 women who underwent UAE at 72 sites. At 12 months, 95% of patients who were followed up reported symptomatic improvement and improved quality of life scores. For the more than 1,200 patients enrolled in this registry, data showed continued statistically significant improvement in symptoms and quality of life based on questionnaires.
- Short-term benefits of UAE versus hysterectomy include shorter hospital stay and decreased blood loss.

Potential Harms

- Overall, the reported complication rates for uterine artery embolization (UAE) remain low, with major complications occurring in <3% of patients. More commonly, up to 10% of patients may need to be readmitted for pain control. Amenorrhea can occur in up to 10% of patients following UAE. The risk of permanent amenorrhea appears to be age-dependent. For women younger than age 45 the risk is <2% to 3%, whereas for women >45 years of age it is up to 20%. The issue of fertility following UAE remains an area of great controversy. The impact on future fertility and subsequent delivery remains uncertain. It has been shown that over 60% of women who attempted to become pregnant after UAE had abnormal hysteroscopies, particularly with higher incidence of intrauterine necrosis (43%).
- A meta-analysis looked at the outcomes of all reported pregnancies in women (n = 227) who had undergone UAE compared to controls from a variety of studies that looked at reproductive outcomes. The significant complications from UAE in these women included an increase in miscarriage (35%), increase in Cesarean sections (66%), and an increase in postpartum hemorrhage (13.9%).
- As with other uterine-sparing procedures, there is uncertainty about the durability of symptom relief with UAE. Trying to identify prospectively which patients will have better clinical results is difficult. Overall, there is 20% to 25% incidence of symptom recurrence at 5 to 7 years after UAE, though most women report continued high quality of life scores.
- Many women who undergo hysterectomy later regret the loss of fertility or have concerns regarding their femininity and may undergo earlier onset of menopause. Increased risk of ovarian failure is a possible consequence of premenopausal hysterectomy, even with ovarian preservation.
- Using either an abdominal or laparoscopic approach to myomectomy, the recurrence rate ranges from 23% to 33%. In a large, multicenter study, laparoscopic myomectomy was associated with 2% major

complication and 9% minor complication rates.

- Medical therapy with either oral contraceptive medication or gonadotropin-releasing hormone (GnRH) agonists/antagonists has several drawbacks. First, once the agent is discontinued, the fibroids quickly return to their previous volume and the fibroid-related symptoms typically recur. In addition, chronic use of GnRH agonists results in trabecular bone loss. Therefore, these agents are typically used for temporary situations, such as to reduce uterine and myoma size prior to surgical therapy. Adverse effects such as pelvic pain and fever may result from use of tranexamic acid.

Contraindications

Contraindications

- Viable pregnancy and active pelvic inflammatory disease are two absolute contraindications for uterine artery embolization (UAE) and must be excluded.
- Morcellation is not recommended in hysterectomy because of risk of increasing stage of possible sarcoma.
- Endometrial ablation (EA) should not be used in women desiring future pregnancy.
- Based on one report, the presence of pedunculated subserosal fibroids was considered a potential contraindication to UAE.

Qualifying Statements

Qualifying Statements

- The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.
- ACR seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply society endorsement of the final document.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Knuttinen MG, Stark G, Hohenwarter EJ, Bradley LD, Braun AR, Gipson MG, Kim CY, Pinchot JW, Scheidt MJ, Sella DM, Weiss CR, Lorenz JM, Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® radiologic management of uterine leiomyomas. Reston (VA): American College of Radiology (ACR); 2017. 13 p. [87 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2017

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The funding for the process is assumed entirely by the American College of Radiology (ACR). ACR staff support the expert panels through the conduct of literature searches, acquisition of scientific articles, drafting of evidence tables, dissemination of materials for the Delphi process, collation of results, conference calls, document processing, and general assistance to the panelists.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Interventional Radiology

Composition of Group That Authored the Guideline

Panel Members: M-Grace Knuttinen, MD, PhD (*Principal Author*); Gregory Stark, MD (*Research Author*); Eric J. Hohenwalter, MD (*Panel Chair*); Linda D. Bradley, MD; Aaron R. Braun, MD; Matthew G. Gipson, MD; Charles Y. Kim, MD; Jason W. Pinchot, MD; Matthew J. Scheidt, MD; David M. Sella, MD; Clifford R. Weiss, MD; Jonathan M. Lorenz, MD (*Specialty Chair*)

Financial Disclosures/Conflicts of Interest

Disclosing Potential Conflicts of Interest and Management of Conflicts of Interest

An important aspect of committee operations is the disclosure and management of potential conflicts of interest. In 2016, the American College of Radiology (ACR) began an organization-wide review of its conflict of interest (COI) policies. The current ACR COI policy is available on its [Web site](#)

. The Appropriateness Criteria (AC) program's COI process varies from the organization's current policy to accommodate the requirements for qualified provider-led entities as designated by the Centers for Medicare and Medicaid Services' Appropriate Use Criteria (AUC) program.

When physicians become participants in the AC program, welcome letters are sent to inform them of their panel roles and responsibilities, including a link to complete the [COI form](#) . The COI form requires disclosure of all potential conflicts of interest. ACR staff oversees the COI evaluation process, coordinating with review panels consisting of ACR staff and members, who determine when there is a conflict of interest and what action, if any, is appropriate. In addition to making the information publicly available, management may include exclusion from some topic processes, exclusion from a topic, or exclusion from the panel.

Besides potential COI disclosure, AC staff begins every committee call with the conflict of interest disclosure statement on the [Web site](#) reminding members to update their COI forms. If any updates to their COI information have not been submitted, they are instructed not to participate in discussion where an undisclosed conflict may exist.

Finally, all ACR AC are published as part of the Journal of the American College of Radiology (JACR) electronic supplement. Those who participated on the document and are listed as authors must complete the JACR process that includes completing the International Committee of Medical Journal Editors (ICMJE) COI form which is reviewed by the journal's staff/publisher.

Dr. Bradley reports personal fees from Medtronic, grants and personal fees from Bayer, other from Elsevier, other from UptoDate, personal fees from Allergan, personal fees from Gynesonics, personal fees from Karl Storz, personal fees from PCORI, and personal fees from abbvie, outside the submitted work. Dr. Weiss reports grants and nonfinancial support from Merit Medical, grants and personal fees from BTG, during the conduct of the study; grants from Siemens Healthcare, personal fees from Medtronic, outside the submitted work.

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Burke CT, Ray CE Jr, Lorenz JM, Darcy MD, Fidelman N, Hohenwalter EJ, Kinney TB, Kolbeck KJ, Kouri BE, Nair AV, Rochon PJ, Shaw H, Vatakencherry G, Expert Panel on Interventional Radiology. ACR Appropriateness Criteria® radiologic management of uterine leiomyomas. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 8 p. [62 references].

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the [American College of Radiology \(ACR\) Web site](#) .

Availability of Companion Documents

The following are available:

ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2017. Available from the [American College of Radiology \(ACR\) Web site](#) .

ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Available from the [ACR Web site](#) .

ACR Appropriateness Criteria®. Evidence table development. Reston (VA): American College of Radiology; 2015 Nov. 5 p. Available from the [ACR Web site](#) .

ACR Appropriateness Criteria®. Topic development process. Reston (VA): American College of Radiology; 2015 Nov. 2 p. Available from the [ACR Web site](#) .

ACR Appropriateness Criteria®. Rating round information. Reston (VA): American College of Radiology; 2017 Sep. 5 p. Available from the [ACR Web site](#) .

ACR Appropriateness Criteria® radiologic management of uterine leiomyomas. Evidence table. Reston (VA): American College of Radiology; 2017. 43 p. Available from the [ACR Web site](#) .

ACR Appropriateness Criteria® radiologic management of uterine leiomyomas. Literature search summary. Reston (VA): American College of Radiology; 2017. 2 p. Available from the [ACR Web site](#) .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on December 3, 2010. This NGC summary was updated by ECRI Institute on November 14, 2012. This summary was updated by ECRI Institute on June 13, 2018. The developer agreed not to review the content.

This NEATS assessment was completed by ECRI Institute on May 30, 2018.

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